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This is a translation of the document entitled “Anlagenspezifische Sicherheitsüberprüfung deutscher Kernkraftwerke unter Berücksichtigung der Ereignisse in Fukushima-I (Japan)”.

In case of discrepancies between the English translation and the German original, the original shall prevail.

Plant-specific safety review of German nuclear power plants in the light of the events in Fukushima-1 (Japan)

On 17-03-2011, the German Bundestag called upon the German Federal Government to

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conduct a comprehensive review of the safety requirements for the German nuclear power plants. For this purpose, an independent expert commission is to be tasked with carrying out a new risk analysis of all German nuclear power plants and nuclear installations with consideration of the knowledge available about the events in Japan – especially also with respect to the safety of the cooling systems and the external infrastructure – as well as of other extraordinary damage scenarios;¹

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On 17-03-2011, the Federal Environment Ministry called upon the Reactor Safety Commission at its 433th meeting to draft a catalogue of requirements for a safety review of the German nuclear power plants and to assess the results of the review carried out on this basis. Here, the insights gained from the accident sequence in Japan are to be considered in particular with respect to whether the current design limits have been defined correctly and how robust the German nuclear power plants are regarding beyond-design-basis events.

At its 433th meeting, the Reactor Safety Commission derived the following provisional insights from the accident in Japan for operating plants as well as for plants in refuelling and overall maintenance inspection outage:

- The consequences of natural events were obviously underestimated in the design.
- The plants shut down automatically despite the extraordinarily strong earthquake; emergency power supply and safety-relevant cooling water supplies (auxiliary service water supply) were initially available.
- As a result of the impact of the tsunami approx. one hour after the earthquake, the emergency power supply - with the exception of the batteries - as well as the auxiliary service water supply failed.
- Several hydrogen explosions destroyed structures with barrier functions as well as further safety installations and contributed to an aggravation of the accident sequence.
- A long-term complete loss of power and auxiliary service water supply had apparently neither been considered in the plant design nor in the planning of accident management measures.

¹ 96th sitting of the German Bundestag on 17-03-2011; motion for a resolution of the CDU/CSU and FDP fractions on the issue of a government policy statement by the Federal Chancellor on the current situation in Japan, printed paper 17/5048

- As regards the organisation and effectiveness of accident management measures, the destruction of the infrastructure had not been adequately taken into account.

As information is still incomplete so far, it can be assumed that further and more specific insights will be added as analyses of the accident sequence proceed.

To this date, the Reactor Safety Commission has derived the following review needs for the German nuclear power plants:

- Examination of to what extent the general safety objectives of "reactivity control", "cooling of fuel assemblies in the reactor pressure vessel as well as in the fuel pool" and "limitation of the release of radioactive substances (keeping up barrier integrity)" are fulfilled in the event of impacts beyond the design requirements applied so far. For this purpose, the robustness (available design margins, diversity, redundancy, structural protection, physical separation) of the safety-relevant systems, structures and components and the effectiveness of the defence-in-depth concept have to be assessed. If this review reveals any insights that design requirements should be modified, the RSK will formulate the corresponding requirements. A generic review of design requirements has to be carried out in a later phase.
- Examination of to what extent the functions for fulfilling the safety objectives remain available for assumptions going beyond the scenarios postulated so far. In this context, postulates regarding the non-availability of safety and emergency systems have to be considered, like e.g. the longer-term loss of power supply incl. the emergency power supply, or the non-availability of the auxiliary service water supply.
- Review of the necessary scope of accident management measures and their effectiveness. Here, the extent and the quality of preliminary planning for postulated event sequences, such as the non-availability of the cooling chain for cooling of the fuel assemblies in the reactor core as well as in the fuel pool, the non-availability of electricity supply, and any massive fuel assembly damage that may occur up to core meltdown, have to be assessed. Furthermore, a substantial destruction of the infrastructure and inaccessibility due to high local dose rates as well as the availability of personnel also have to be assessed.

One focus of the review regarding the robustness of all installations and measures is on the identification of an abruptly occurring aggravation in the event sequence (cliff edges) and, if necessary, on the derivation of measures for its avoidance (example: exhaustion of the capacity of the batteries in the event of a station blackout).

According to present knowledge, the scope of the review has to include the following:

- Natural events such as earthquakes, flooding, weather-related consequences as well as possible simultaneous occurrences.
- Postulates that are independent of concrete event sequences, such as failures affecting several redundant system trains, (common-cause failures, systematic failures), station blackout for longer than two hours, long-lasting loss of auxiliary service water supply.

- Aggravating boundary conditions for the performance of emergency measures, such as non-availability of electricity supply, hydrogen formation and explosion risk, restricted availability of personnel, inaccessibility due to high radiation levels, aggravation of external technical support.

Furthermore, due to further-reaching aspects, man-induced events such as e.g. aircraft crash, blast pressure wave, and deliberate attack on safety-relevant installations are included in the scope of examination.

For each topic to be dealt with, the RSK shall prepare a definition of the task and pose the associated questions.

From the point of view of the RSK, GRS should take the leading role in the review, acting on the instructions of the RSK and involving other expert organisations. The RSK will assess the individual results on the basis of criteria to be defined by itself, show up the safety status of the plants with application of the extended requirements, and recommend measures if necessary. It is intended to carry out the review sequentially over time. According to the order given by the BMU, a first statement has to be submitted by 15 May 2011.